

# MONTHLY WEATHER REVIEW,

## JULY, 1874.

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WAR DEPARTMENT,

*Office of the Chief Signal Officer,*

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

### INTRODUCTION.

A careful examination of the meteorological data accumulated in this office during the past month, from both the regular and volunteer observers, has rendered it necessary to consider facts referring to an unusual series of atmospheric phenomena.

The month has been particularly marked in the occurrence of severe local storms, which have, in some cases, proved greatly destructive to both life and property.

The accompanying charts show an intimate relation existing between the barometric pressure, temperature, prevailing direction of winds and moisture, in the several geographic districts, and illustrate in a forcible manner that each of the elements above-named is an important but variable function of the weather, while a comparison with previous months and years would indicate that decided changes in atmospheric conditions depend more directly upon the supply of aqueous vapor.

Generally, the weather has been favorable for agricultural pursuits. This is especially so on the Pacific coast, where the yield of wheat is reported to be greater than in previous years, although there are sections in the northern portion of this region where excessive rains have been injurious, and the low temperature prevented the maturing and ripening of the grain.

It is now quite certain that the late frosts, which occurred in Virginia, North Carolina, Mississippi and Tennessee, will materially reduce the fruit crop in these regions, and that the drought in the Ohio valley, Tennessee and Arkansas, has caused an almost total failure of the Tobacco crop. There has been a deficiency of rain in the regions north and west of the Ohio valley, but the excess in previous months has produced excellent crops, except in limited localities, where drought or insects have completely destroyed vegetation. In some districts the agricultural interests have been improved by the occurrence of timely rains, while in others too much rain, or almost a total absence of it, has caused a total failure of particular crops.

### BAROMETRIC PRESSURE.

The influence of the land upon atmospheric pressure has been unusually well marked. Upon chart No. II, is represented the general distribution of this pressure for the month. A comparison of the months of June and May shows that the area of mean low barometer has moved slowly to the northeastward, and that it now extends

over the centre of the continent; in the meantime the barometric pressure has increased in the southern and southeastern portions of the country which is now within the limits of the increased area of high barometer extending over the Atlantic, between the twenty-fifth and fortieth degrees of latitude. During the past three months there has been a gradual increase of pressure in the region last-named, the direction of increase being westward from the Atlantic, while, during the same time, there has been but little change in the mean barometric readings of the central depression. Compared with July, 1873, there has been but little change, both years showing an excess of the mean pressure previously calculated. On the Pacific coast there has been no marked variation from the monthly mean, the pressure being greatest at Portland, Oregon, and least at San Diego, Cal., thus indicating that the mean pressure on this coast increases with the latitude, within the limits of the United States, while the reverse obtains on the Atlantic coast. The barometric range is shown to be greatest in the northern districts near the forty-fifth parallel of latitude, and from this region southward it is gradually diminished, finally becoming least in Florida.

*Areas of high barometer.*—These areas are not traced on the charts, but their general direction of progression has been from the northwest to the southeast; they have moved with less rapidity after reaching the Atlantic, becoming more extended in longitude, conforming to the general contour of the coast, and in some cases extending to the westward, in the direction of the Gulf coast. They have also been uniformly attended by fair weather, falling temperature and less relative humidity, and followed by rain, especially in the Atlantic and Gulf States, after the winds had shifted to easterly.

No. I. The first area observed was central off the South Atlantic coast on the 4th, and gradually extended to the westward, apparently following and displacing the depression which existed in the Gulf during the 2d, 3d and 4th.

No. II. Was central in Manitoba on the 10th, passed thence almost due east to the Atlantic by the afternoon of the 12th; after which the pressure increased in the Atlantic and Southern States, and on the 15th it was still traced in the southeastern portion of the country.

No. III. Observed in the Missouri valley on the 15th, had passed from the Pacific coast southeastward to this position, after which it extended over the southern portions of the country and disappeared on the 26th.

No. IV. During the 28th, 29th, 30th and 31st, this area moved from the Northwest to the South Atlantic coast, succeeding the depression which was attended by unusual rains in the Eastern and Middle States.

*Areas of low barometer.*—Eleven areas of atmospheric depression have been observed, some of which originated and disappeared within the limits of the United States, while the greater number passed to the north of the Lake region on a mean latitude greater than that of similar depressions in previous years. This fact, which was noticeable in July, 1873, is now equally marked, as will appear from the following comparative statement:

July, 1871,	No. of areas of Low Barometer,	15;	mean latitude of same,	45°
July, 1872,	" " " "	14;	" " "	44°
July, 1873,	" " " "	13;	" " "	47°
July, 1874,	" " " "	11;	" " "	47°

From the above it will also be observed that there has been a gradual decrease in the number of defined areas of low barometer, a fact which is also noticeable in comparing records of June with 1874 and 1873.

The approximate geographical position of the centre of each depression at each of the tri-daily reports during the time the depression remained within or near the stations of observation, is given on Chart No. 1, and through these points have been traced the general course of the depression.

No. I Was apparent in Manitoba on June 30th, and moved rapidly toward the Atlantic coast during July 1st and 2d, following the general course of the great lakes and moving with less progressive velocity as it approached the coast.

No. II Was attended by the unusual rains near the Gulf coast during the 2d, 3d and 4th, and is interesting from the fact that it is the first barometric depression of the season which originated in the tropics, having a progressive movement to the westward. This storm has it parallel in July of last year, but usually they are not observed within the limits of the United States until the season is more advanced. Its westerly course with a velocity of twelve miles per hour carried the center of the depression slowly toward the dry and sandy plains of Texas, where it disappeared and was followed by the succeeding high barometer from the Atlantic coast, which now moved to the westward and became central in the lower Missouri valley on the morning of July 6th. The same cause which produced the shifting of the mean tracks of barometric depressions in the temperate zone may be equally effective in changing the mean latitude of tropical storms.

No. III. The approach of this depression from the extreme northwest was indicated by the reports from that region on the 2d July, while No. 1 continued within the limits of the eastern station and No. 2 in an undeveloped condition in the Gulf. It passed from its initial position to the eastward as far as Lake Huron without marked results, except that on the morning of the 3d it had almost lost its identity as a defined area of low barometer, the centre of depression having increased thirty-five hundredth of an inch and the gradient diminished from 0.1 inch in eighty miles to 0.1 inch in two hundred miles. On the morning of the 4th, this depression had taken the form of a slightly eccentric ellipse, the transverse axis of which coincided with the 44° of north latitude and was 400 miles in length.

The area of high barometer which had previously extended over the districts on the Atlantic coast, and which by its southerly wind had accumulated a supply of vapor in these districts, now moved to the south and westward, apparently drawing the depression toward the coast in the most direct line. In this, as in other storms, there has been a deviation to the south of the direct course as the depression approached the coast.

Severe local storms occurred in the southern half of this depression, while its centre was near the eastern portion of Lake Erie. The region of greatest severity being near the Atlantic coast and including New Jersey, Delaware, Maryland and the eastern portions of Pennsylvania and Virginia.

Nos. IV and V. No decided change occurred in the atmospheric condition within the United States until the 7th, although there seems to have been some disturbance in the lower St. Lawrence valley which caused local storms in the northern portions of New York. The general barometric depression in the Northwest now contracted as an area



of low barometer, central in the western portions of Kansas, and moved slowly to the eastward during the succeeding twenty-four hours, completely lost its cyclonic appearance in the upper Mississippi valley. This was succeeded by No. V, an extensive depression central in the upper Ohio valley, indicating an unstable condition of the atmosphere throughout the country east of the Mississippi river. After the barometric gradient had increased, this storm passed to the northeast to the Lower Lake region, where it seems to have been retarded, the easterly movement of its centre during thirty-six hours being less than 250 miles, while its movements in latitude were much greater.

No. VI. This disturbance was indicated by the appearance of an extended trough of barometric depression on the afternoon of July 11. It had taken the form of a circular depression, central in the upper Ohio valley on the succeeding morning, when a small central area could be distinctly traced. A general rain prevailed at this time in the districts of the Atlantic coast and in the Lower Lake region, the course of the storm being directly to the east, with a mean velocity of twenty-five miles per hour, and a greatest barometric gradient of 0.1 inch in fifty miles.

No. VII. Observed in the Northwest on the morning of the 14th, while an area of decidedly high barometer extended over that portion of the United States south of the Lake region. These general conditions continued while this depression moved almost directly east toward the lower St. Lawrence valley without producing any serious disturbance within the limits of the United States. Generally it has been observed that the relative positions of the areas of high and low barometer materially affect the course of the latter, and that the former seem to deflect the latter from their mean tracks.

Nos. VIII and IX. Were only partially developed areas of low barometer, central in the Northwest near the boundary of the United States on the 18th and 22d. They produced no disturbance, but caused a rise of temperature in the Mississippi valley.

From the 21st until the 25th, the barometer continued low in the Western Territories with but slight changes of pressure within the States until the development of storm marked No. X, which can be traced to the west of the Rocky Mountains by a reference to the barometric readings taken at the stations in the far West. This storm moved with quite a uniform velocity of about 40 miles per hour, producing heavy rains over a belt of country seven hundred miles in width, extending from the upper Mississippi valley to the Atlantic coast. The midnight reports of July 26th shows that the depression divided, leaving a small elliptical area in the Ohio valley to the southwest of Lake Erie, while the principal area was to the northeast of this position. Such a distribution of pressure would necessarily give a continuous supply of warm moist air flowing from the southeast over Ohio and Pennsylvania, while a supply of cold currents flowing from the north and west in the rear of the more advanced depression would be forced over the same region. It was the sudden interference of these currents which produced the heavy rains which occurred in Western Pennsylvania on the night of the 26th. On the morning of the 27th the depressions had again united, forming an extended but narrow trough nearly parallel to the coast, where southerly winds continued, while in the Lower Lake region and the St. Lawrence valley the winds had backed to north and west. This depression did not pass directly to the Atlantic, but apparently extended over the entire country south of the Lake region and continued until the 29th, when it was replaced by an equally extensive area of high barometer.

No. XI. The afternoon report of the 29th from the Northwest indicated the approach of this depression, but at no succeeding report could its center be more than approximately located; it passed to the north of the lakes, and was only attended by light local rains in the regions north of the Ohio valley

*Local Storms.*—These storms have been particularly marked for their severity during the past month. Their occurrence seems to depend upon the relative distribution of barometric pressure considered in relation to the topography of the country. The region of greatest frequency has been in the vicinity of the Appalachian chain, where the vapor from the Gulf and the Atlantic was forced over the ascending plains by the prevailing southerly and southwesterly winds. Those producing the greatest destruction of life and property occurred on the 4th, 7th, 24th and 26th of the month. On the afternoon of July 4, the depression already referred to as No. 3, was central near the eastern portion of Lake Erie; at midnight this depression was located near the eastern boundary of New York, south of its previous position. The sudden veering of the winds in the south and west quadrants of this area was attended by violent storms during the afternoon and evening in the States of Maryland, Virginia, Delaware, New Jersey and Pennsylvania. From an examination of a large number of reports referring to these storms, it is shown that the regions of severity were limited in area, and that the storms uniformly approached from the northwest. The storm of the 24th occurred at Eureka, Nevada, and was very destructive; but no official report has been received concerning it.

The remarks referring to the area of low barometer, marked No. X, considered in connection with the peculiar arrangement of clouds at Erie, Pennsylvania, during the evening of the 26th, which was as follows:—"Three distinct strata of clouds: *First*, black cumulo-stratus moving from the southwest; *Second*, heavy cumulus well defined, moving from a little north of west; *Third*, cirro-cumulus moving from the north," give the general atmospheric conditions which attended the unusually heavy rains occurring in western Pennsylvania on that date. The official report from the Observer at Pittsburgh, states that the total number of lives lost at or near that city is one hundred and thirty-four, and that property valued at five hundred thousand dollars was destroyed.

## PRECIPITATION.

In the construction of Chart No. 3, which is a graphical representation of the distribution of rain in the United States, the regular and volunteer reports have been combined with those furnished by Professor Kingston, of the Toronto Observatory. From the comparative tables accompanying the chart, it will be observed that the districts showing an excess over the normal are near the coast, and that the regions of excess of rain correspond with those in which the mean temperature has been below the normal. Within the large area representing less than two inches of rain, there are small districts where there has been a total absence of it. Special droughts have prevailed, proving injurious to crops, in Kentucky, Arkansas, Texas, Missouri and Kansas.

*Cloudy Days.*—The number of cloudy days reported from the Signal Service Stations average as follows: Six on the Gulf coast, eight on the South Atlantic coast, seven on the Middle Atlantic coast, twelve on the East Atlantic coast, three in the Lower Mississippi valley, six in the Ohio valley, seven in the Upper Mississippi valley, four in the Lower Missouri valley, and six in the Lake region.

*Rainy Days.*—The number of days on which rain fell are as follows: Eleven in the Gulf States, fifteen in the South Atlantic States, eleven in New England, eleven in the

Lower Lake region, nine in the Upper Lake region, eight in the Upper Mississippi valley, seven in the Lower Mississippi valley, and twelve over the Blue Ridge and Alleghanies.

*Special Rains.*—Remarkably heavy rains occurred on the 3d at Wilmington, Charleston and Savannah; on the 4th at New Orleans and Mobile; on the 12th at Hinsdale, Mass.; on the 24th at Eureka, Nevada; on the 26th at Pittsburgh and Allegheny City, Penn., and at Port Huron, Michigan; on the 27th at Rising Sun, Indiana.

### HUMIDITY.

During the month of July the relative humidity has averaged as follows in the different sections of the country:

On the Gulf and South and East Atlantic States, .75; on the New Jersey coast, .85; in the Lake region, .68; in the Lower Mississippi valley, .70; in Tennessee and the Ohio and Upper Mississippi valley, .62; in the Lower Missouri valley, .58; at the Rocky Mountain stations, .41.

### ATMOSPHERIC TEMPERATURE.

The mean isothermal lines for the month are represented on Chart No. II, and the comparison of the mean temperature of the several districts with that of the mean temperature of July in previous years is given in the table. It will be seen that the temperature has been above the mean in the districts of the Mississippi valley and below it in the districts near the coast; this has been particularly noticeable on the Middle Atlantic and New England coasts and at San Francisco. The range of temperature compared to that of 1873 has diminished slightly on the Gulf coast and increased in the northern sections of the country. The unusual high temperature of 100° prevailed over an extensive region, including Indian Territory, Missouri, Kansas, Nebraska and portions of Iowa and Arkansas on the 25th of the month. The mean temperature at the summit of Pike's Peak was 42°, that at the summit of Mount Washington, 48°.5.

Frosts were reported on the 10th in Colorado, and on the 27th in Minnesota.

### TEMPERATURE OF WATER.

The table on Chart No. III gives the maximum and minimum temperature of water by observations made at the bottom at many of the Signal Service stations on lakes, rivers and coasts. The range of temperature of the water on the Atlantic seaboard has been about five degrees and on the Gulf coast seven degrees. In Lake Erie the range varies from five degrees at Buffalo to fourteen degrees at Cleveland. In Lake Michigan from nine degrees at Chicago to nineteen degrees at Milwaukee, and in Lake Superior from fourteen degrees at Marquette to twenty-one degrees at Duluth. The range averages about fourteen degrees in the Ohio, nine degrees in the Upper Mississippi and four degrees in the Lower Missouri.

The difference between the maximum air temperature and maximum water temperature has been greatest on the coast of Maine and near Lake Superior, where it has averaged thirty degrees; this difference has been least in the Gulf and on the South Atlantic coast, where it has averaged nine degrees. At the stations on the western rivers the temperature of the air has risen from twelve to twenty-five degrees above the highest water temperature.

The minimum air temperature has been lower than the minimum water temperature at nearly all stations, the only exception being at Duluth, where the water temperature



was five degrees lower than the air, and at Milwaukee and Eastport where it has been two degrees colder. The mean temperature of the water has been slightly above the mean temperature of the air on the Gulf and South Atlantic coasts and in the Ohio, Cumberland and Tennessee rivers. In Lake Michigan the water has averaged colder than the air by seven degrees; in Lake Superior by fourteen degrees, and on the coast of Maine by twelve degrees.

### WINDS.

Southerly winds have prevailed throughout the United States east of the Rocky Mountains. Chart No. II shows the mean direction as obtained from each of the stations of the Signal Service, and it will be observed that these directions are generally toward the area of mean low barometer. The total atmospheric movement, independent of the direction, has been as follows in the several districts: New England, 5,280 miles; Middle Atlantic coast, 6,480 miles; interior of the Middle Atlantic States, 4,690 miles; South Atlantic coast, 4,730 miles; Gulf coast, 5,650 miles; Ohio, Tennessee and the interior of the Gulf States, 3,360 miles; Lower Lake region, 5,710 miles; Upper Lake region, 6,370 miles; Upper Mississippi valley, 6,395 miles; Missouri valley, 3,517 miles. Violent winds occurred at Washington, D. C., July 4th, 60 miles; Mt. Washington, New Hampshire, July 9th, 96 miles; Milwaukee, Wisconsin, July 9th, 63 miles; Long Branch, July 26th, 50 miles. Tornadoes were reported at Three Mile Bay, New York, July 7th; Bass Harbor, Maine, July 16th; Lexington, Michigan, July 24th; South Bend, Indiana, July 26th.

Dove's law of gyration received four complete verifications at Signal Service observatory in this city, with a single backing of the wind through an arc of 180 degrees.

### NAVIGATION.

From the Table on Chart No. III, which gives the condition of the western rivers, it will be seen that the Mississippi and Missouri rivers have declined slowly during the month, the lowest readings being those made on the 31st. The Ohio river experienced a sudden rise during the 26th, 27th and 28th, which caused some damage near Cincinnati.

Comparative observations of the fluctuations of the barometer and the water in Lake Superior at Marquette, Michigan, show that the mercury and the water acted together thirty-four times, and in an opposite direction fifty-nine times.

An unusual wave occurred at the east end of Lake Erie on the 25th, causing the water to rise three or four feet, the water returning to its normal condition as rapidly as it rose. A similar wave occurred at Northport, Michigan, on the 31st.

### ELECTRICAL PHENOMENA.

The local storms previously referred to, were, in many instances, accompanied by vivid displays of lightning. The most remarkable series of thunder storms occurred at the summit of Pike's Peak from the 14th to the 25th, during which the electrical effect was so intense as to interrupt telegraphic communication with that station. The observer reports that sharp peculiar sounds were emitted from all pointed objects, and that painful sensations were experienced in the hands and face.

A brilliant display of ball-lightning was observed at Denver, July 21st, the ball exploding in full view and the fragments re-exploding as they reached the earth; this phenomena was also observed at Keokuk, Iowa, on the 16th.

Ground currents interfered with the working of the telegraph line at Sandy Hook on the 4th, 11th and 16th.

*Auroras*.—The auroral display during the month has in some localities been unusually brilliant. The region of greatest frequency being near the 45th parallel of latitude.

### OPTICAL PHENOMENA.

*The Solar Halos* observed at more than one station on any particular date, were those reported from New York, Indiana and Maine, on the 1st; New York, Ohio, Illinois and Mississippi, on the 17th; Illinois, Iowa and Vermont, on the 21st; Tennessee and Maine on the 31st. *Lunar Halos* were observed in Georgia and Mississippi on the 8th; Indiana, New York and Michigan, on the 19th; Tennessee, Georgia and Iowa, on the 22d; Tennessee and Mississippi on the 25th; Rhode Island and Vermont on the 27th, and Vermont and Delaware on the 30th.

*Fog Bow*.—This phenomena was observed at Oxford, Maine, on the 25th.

*Mirage* occurred at New London on the 18th.

### MISCELLANEOUS.

*Polar bands* were observed at Key West on the 4th, and at Toledo on the 1st.

*Brilliant meteors* have appeared in large numbers during the month, the most noted being those observed in Indiana, Missouri and New York, on the 3d; Kentucky, Missouri and Tennessee, on the 7th; Nova Scotia (near Halifax) on the 9th; Pennsylvania and New York on the 19th.

*Earthquakes*.—Light but perceptible shocks were experienced at Cairo, Illinois, July 9th, at 4 p. m., and at Camp Russell, Nebraska, July 23d.

### VERIFICATION OF PROBABILITIES.

*Probabilities*.—The critical comparison between the separate items of the published tri-daily probabilities and the subsequent weather reports, shows that on the average, during the month, 85.7 per cent. of the predictions have been well verified.

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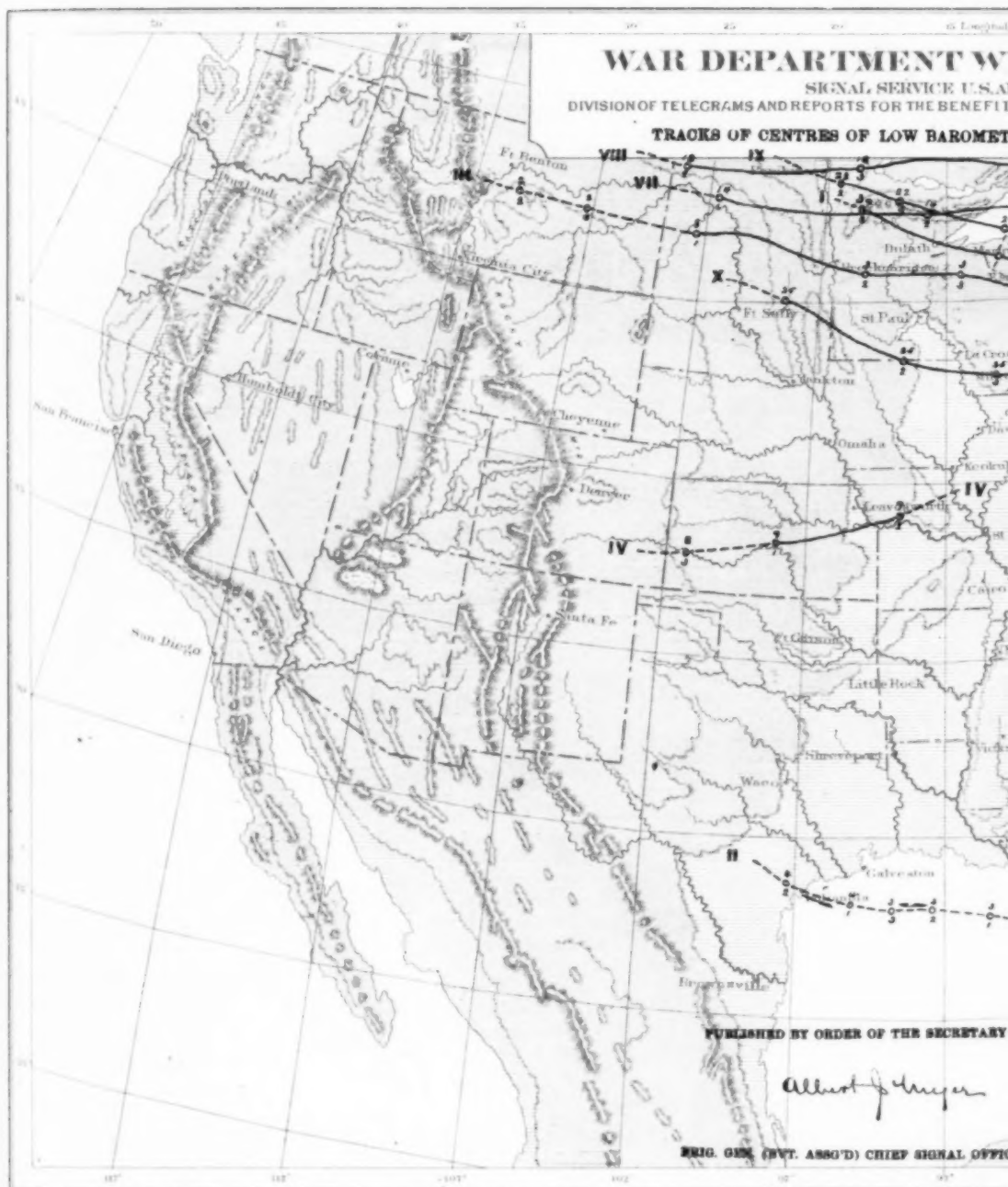
Albert J. Myer

Brig. Gen. (Bvt. Assg<sup>l</sup>.) Chief Signal Officer, U. S. A.

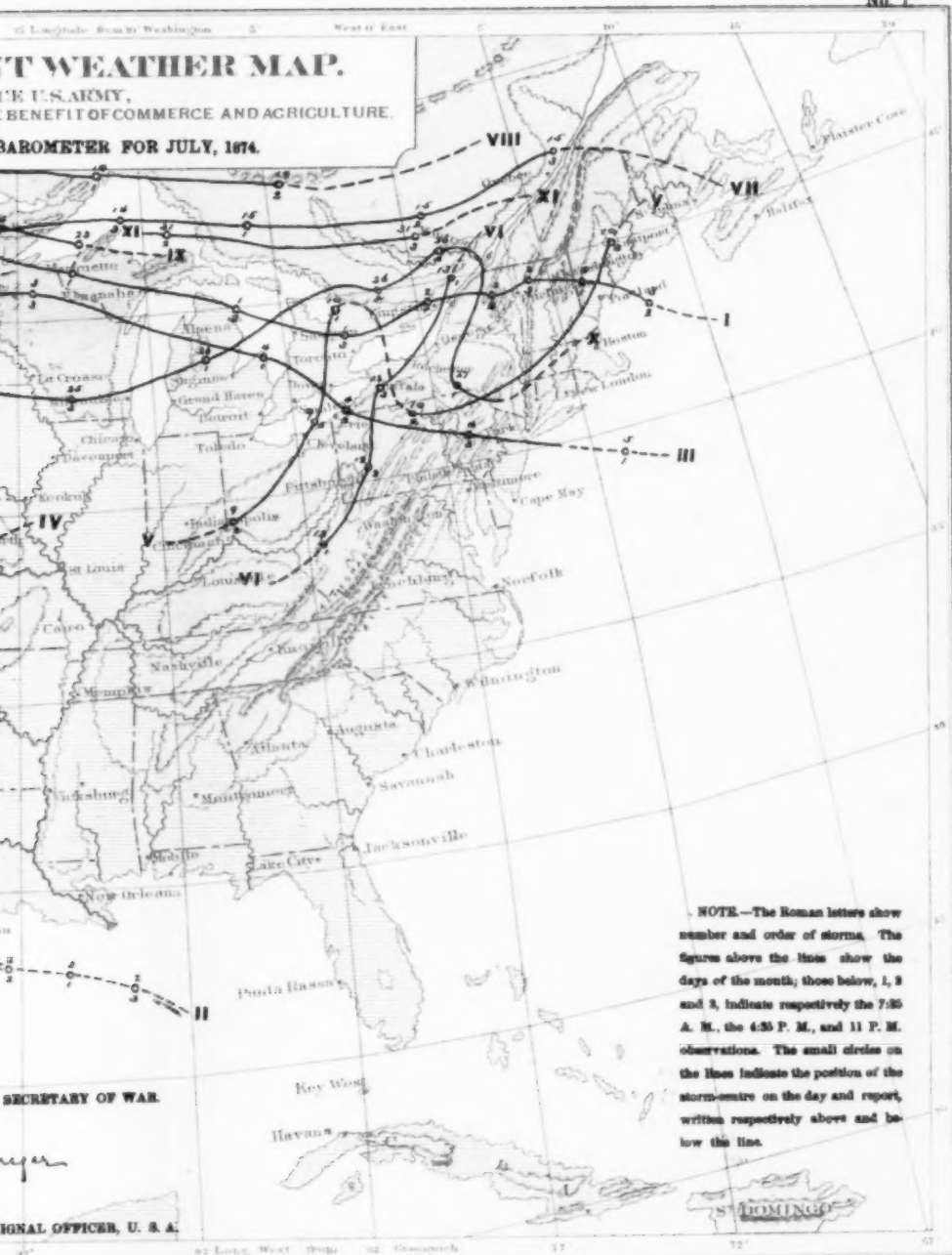
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WEATHER MAP.  
 THE U.S. ARMY,  
 FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.  
 BAROMETER FOR JULY, 1874.



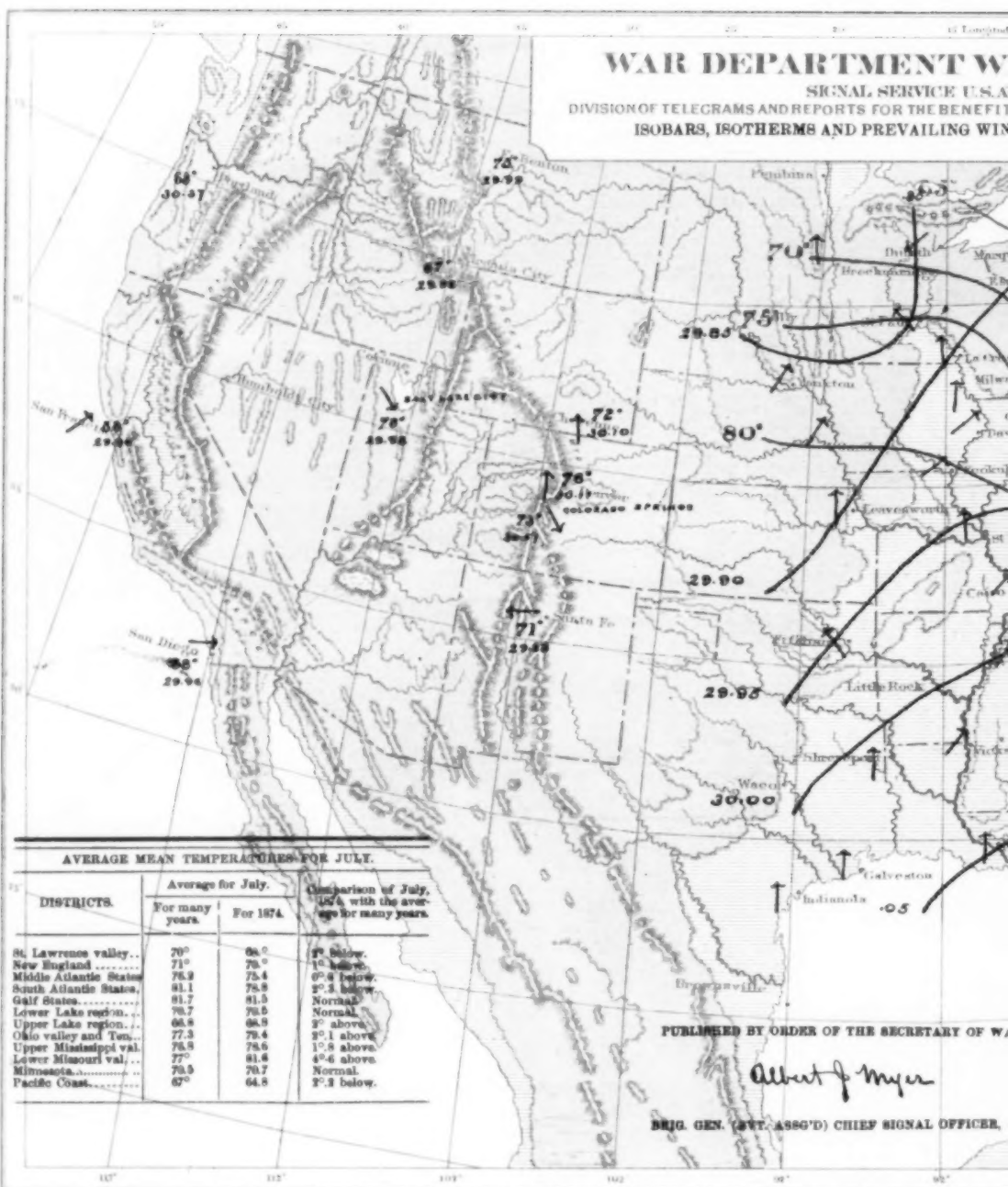
SECRETARY OF WAR.

SIGNAL OFFICER, U. S. A.



# WAR DEPARTMENT W

SIGNAL SERVICE U.S.A.  
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT  
ISOBARS, ISOTHERMS AND PREVAILING WINDS



AVERAGE MEAN TEMPERATURES FOR JULY.

DISTRICTS.	Average for July.		Comparison of July, 1874, with the average for many years.
	For many years.	For 1874.	
St. Lawrence valley..	70°	68.0	2° below.
New England.....	71°	70.0	1° below.
Middle Atlantic States	72.9	72.4	0° 5 below.
South Atlantic States.	81.1	78.9	2° 2 below.
Gulf States.....	81.7	81.5	Normal.
Lower Lake region..	78.7	78.5	Normal.
Upper Lake region..	68.8	68.9	1° above.
Ohio valley and Ten..	77.3	78.4	1° 1 above.
Upper Mississippi val.	76.9	78.6	1° 6 above.
Lower Missouri val..	77°	81.6	4° 6 above.
Minnesota.....	79.5	79.7	Normal.
Pacific Coast.....	67°	64.8	2° 2 below.

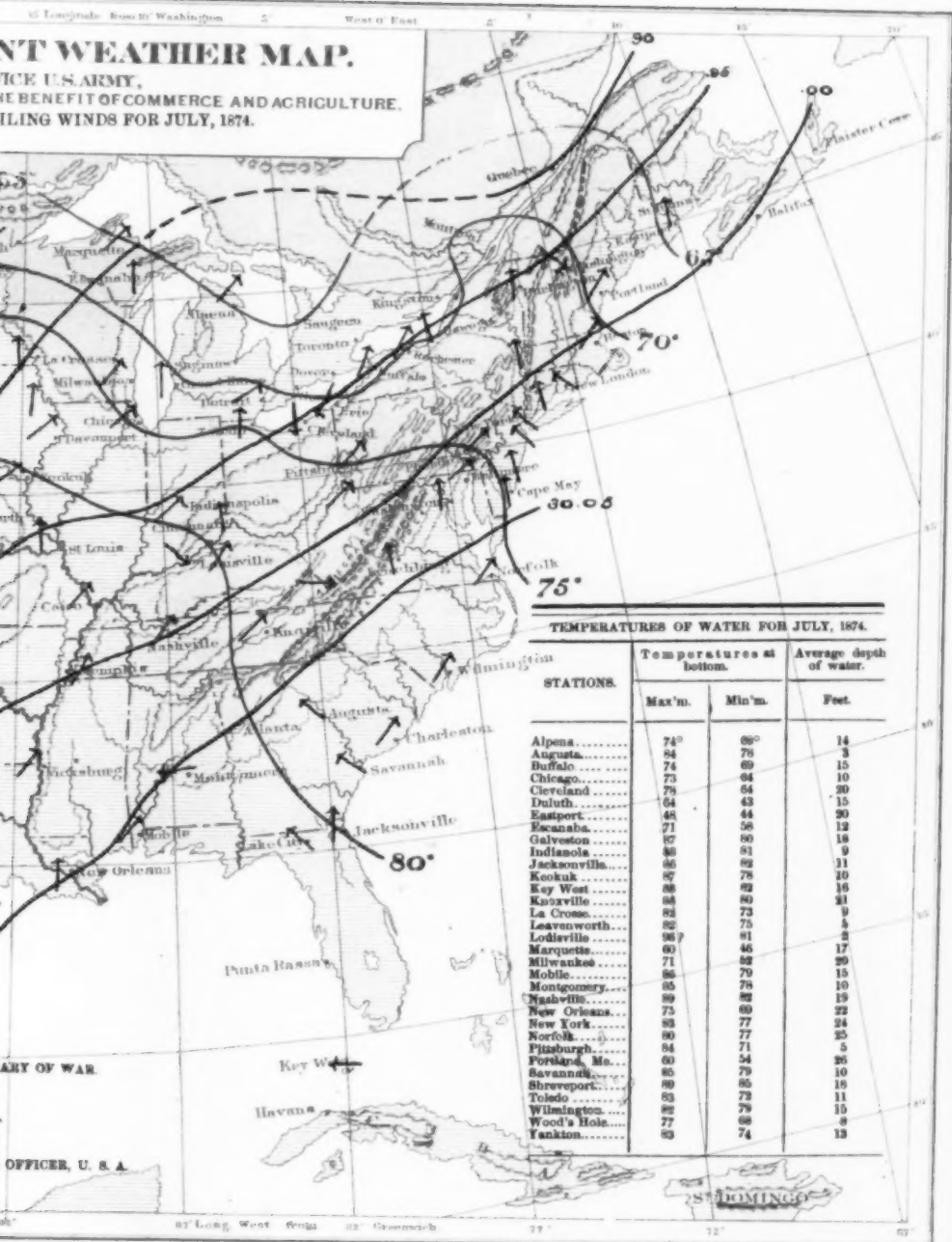
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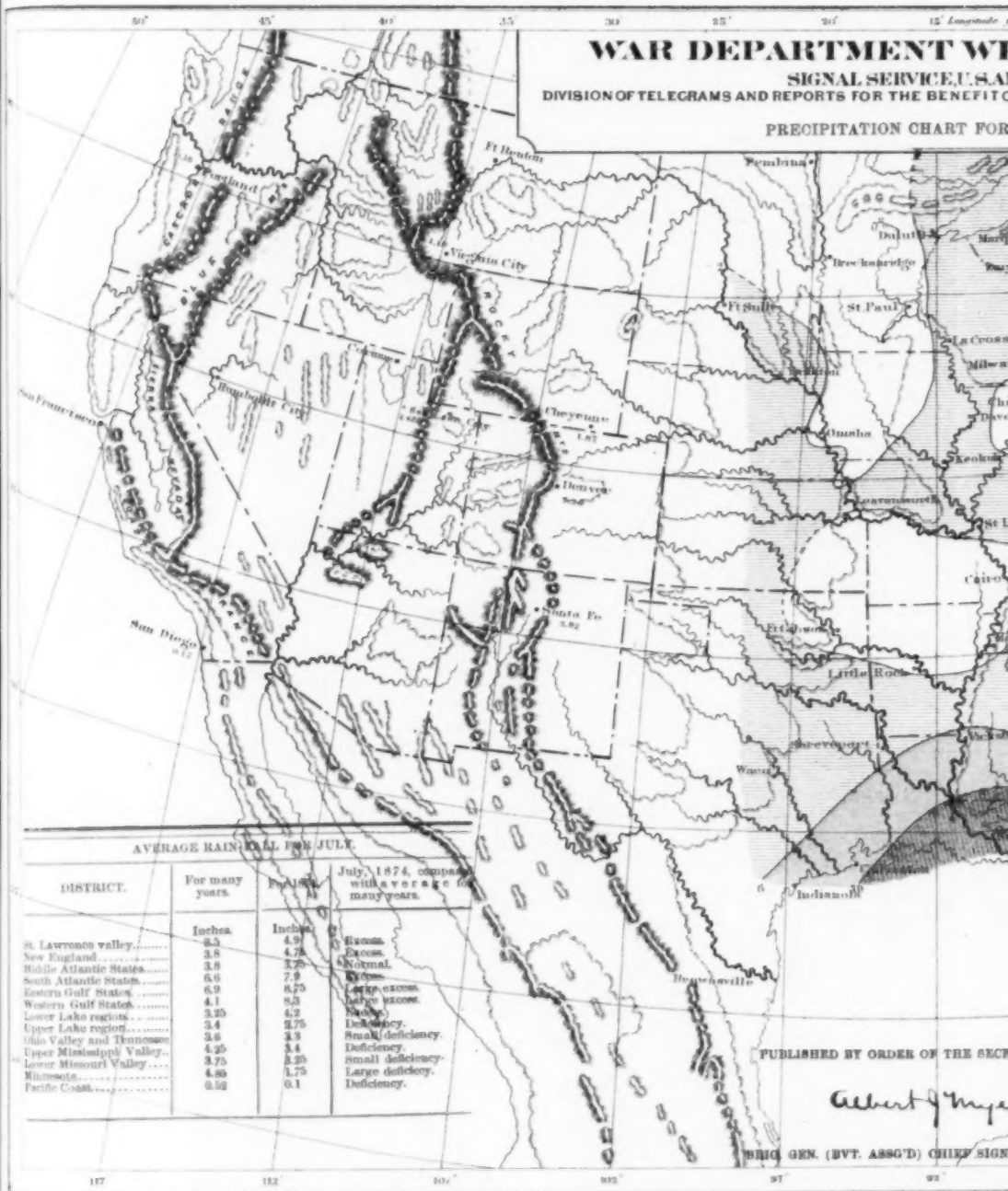
BRIG. GEN. (RET. ASSG'D) CHIEF SIGNAL OFFICER.

## NT WEATHER MAP.

ICE U.S. ARMY,  
RE BENEFIT OF COMMERCE AND AGRICULTURE.  
ILING WINDS FOR JULY, 1874.



STATIONS.	Temperatures at bottom.		Average depth of water.
	Max'm.	Min'm.	
Alpena.....	74°	69°	14
Augusta.....	84	76	3
Buffalo.....	74	69	15
Chicago.....	73	64	10
Cleveland.....	78	64	20
Duluth.....	64	43	15
Eastport.....	44	44	10
Escanaba.....	71	56	12
Galveston.....	87	80	18
Indianola.....	86	81	9
Jacksonville.....	86	78	11
Keokuk.....	87	78	10
Key West.....	88	82	16
Knoxville.....	84	80	21
La Crosse.....	83	73	9
Leavenworth.....	82	73	8
Lodi.....	69	61	3
Marquette.....	67	46	17
Mobile.....	86	79	15
Montgomery.....	85	79	10
Nashville.....	89	82	19
New Orleans.....	75	60	22
New York.....	83	77	24
North.....	80	71	25
Pittsburgh.....	84	71	5
Portland, Me.....	80	54	16
Savannah.....	80	75	20
Shreveport.....	80	85	16
Toledo.....	83	73	11
Wilmington.....	82	79	15
Wood's Hole.....	77	68	8
Yankee.....	82	74	13





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